US005799287A

United States Patent [19]

Dembo

[11] Patent Number: 5,799,287

[45] Date of Patent: Aug. 25, 1998

[54] **METHOD AND APPARATUS FOR OPTIMAL PORTFOLIO REPLICATION**

[76] Inventor: **Ron S. Dembo**, 822 Richmond St. W., Toronto, Ontario, Canada, MCJ 1C9

[21] Appl. No.: **866,303**

[22] Filed: **May 30, 1997**

Related U.S. Application Data

[63] Continuation of Ser. No. 248,042, May 24, 1994, abandoned.

[51] **Int. Cl.**[6] **G06F 157/00**

[52] **U.S. Cl.** **705/36**

[58] **Field of Search** 705/36, 37, 35; 395/925

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,346,442	8/1982	Musmanno	364/408
4,642,768	2/1987	Roberts	364/408
4,674,044	6/1987	Kalmus et al.	364/408
4,694,397	9/1987	Grant et al.	364/408
4,722,055	1/1988	Roberts	364/408
4,744,026	5/1988	Vanderbei	364/402
4,744,027	5/1988	Bayer et al.	364/402
4,744,028	5/1988	Karmarkar	364/402
4,752,877	6/1988	Roberts et al.	364/408
4,797,839	1/1989	Powell	364/554
4,953,085	8/1990	Atkins	364/408
5,101,353	3/1992	Lupien et al.	705/37
5,148,365	9/1992	Dembo	364/402

OTHER PUBLICATIONS

Goddard, Claire, Measuring Treasury Performance, Mortgate Finance Gazette, May 6, 1992, pp. 1–2.

World: Forex–A World of Options, Euromoney Supplements, Nov. 17, 1989, p. 3.

Stein, Jon, Where Corporate Treasurers Can Look for Help, Futures, Oct. 1989.

"Derosa ARBS Japanese Warrants Against Nikkei Options", *Derivatives Week*, May 4, 1992, vol. I, No. 5, p. 2.

Wiest, "Portfolio Gains Favor in FX Mangement", *Reuter's BC Cycle*, Apr. 6, 1992.

Elgin, "Portfolio Hedging Emerges in New Forms to Shield Investments: Investments and Benefits", *Corporate Cashflow Magazine*, vol. 11, p. 22.

Hansell, "Is the World Ready for Synthetic Equity", *Institutional Investor*, Aug. 1990, p. 54.

Voorkees, "Can Portfolio Insurance Make a Comeback", *Institutional Investor*, Jan. 1988, p. 57.

Ring, "Wells Fargo Gets Most New Business in Dynamic Wedging", *Pensions & Investment Age*, Feb. 9, 1987, p. 31.

Dembo et al., "Tracking Models and the Optimal Regret Distribution in Asset Allocation", *Applied Stochastic Models and Data Analysis*, 1990, vol. 8, pp. 151–157.

Dembo, "Scenario Optimization", *Annals of Operation Research*, 30 (1991) pp. 63–80.

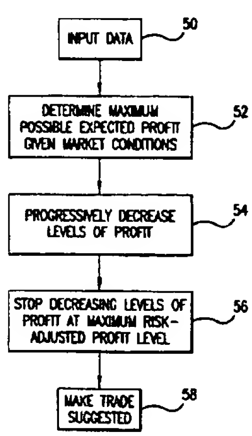
(List continued on next page.)

Primary Examiner—Donald E. McElheny, Jr.
Attorney, Agent, or Firm—Kenyon & Kenyon

[57] **ABSTRACT**

A method and apparatus for determining an optimal replicating portfolio for a given target portfolio involves an initial step wherein a user defines a target portfolio to be replicated, a set of available market instruments from which the replicating portfolio may be created, a set of future scenarios, a horizon date, and a minimum profit to be attained. A representation of the trade-off between risk and expected profit for some arbitrary replicating portfolio is then determined and used to calculate a maximum risk-adjusted profit. The maximum risk-adjusted profit reflects that level of return that may be achieved with an optimum degree of risk; that is, it reflects that point in the risk/reward trade-off where a marginal cost of risk is equivalent to a marginal benefit attainable by assuming that risk. The method then uses the predefined set of available market instruments to identify a set of transactions that will create a replicating portfolio that will achieve the maximum risk-adjusted profit. The method and apparatus also derives the information required to compute a risk premium for pricing of portfolios in incomplete markets, and performs the computation.

12 Claims, 8 Drawing Sheets



OTHER PUBLICATIONS

Torres, "'Synthetic' Stock: Future Stand-In for the Real Thing", *The Wall Street Journal*, Oct. 19, 1990.

Torres, "Mathematician Race to Develop New Kinds of Trading Instruments", *The Wall Street Journal*, Oct. 18, 1991.

Stoffman, "The Hedging Hotshot of Bay street", Dec. 1990, pp. 56–59.

Dembo et al., "French Dressing", *Equity Derivatives*.

Dembo et al., "Protective Basket," *Options*, vol. 3, No. 2, Feb. 1990, pp. 25–28.

Dembo, "The Art of the Qptimum", *Risk*, vol. 3, No. 4, Apr. 1990, pp. 17–21.

Dembo et al., "Share the Load", *Risk*, vol. 4, No. 4, Apr. 1991, pp. 44–47.

Davidson, "Drawing on Data", *Technology*, pp. 49–53.

"The Cafe Behind the Hedge", *Open Finance*, Summer 1992.